



National Spent Nuclear Fuel Program

Post-Closure Criticality Packaging Report

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*Providing for safe,
efficient disposition of
DOE spent nuclear fuel*

Outline

- Background
- Criticality Grouping/Representative Fuels
- DOE SNF inventory covered by these analyses
- Important criticality parameters
- Packaging strategies to include remaining DOE inventory
- Summary



Background

- As part of the grouping effort in 1998, DOE SNF were placed in 9 criticality groups based on fuel matrix and fissile species and enrichment
- Based on the fuel groups, criticality analyses have been completed for a representative fuel in each fuel group using the codisposal concept



Fuel Group/Representative Fuel

<u>Criticality Fuel Group</u>	<u>Representative Fuel Analyzed</u>
U-metal	N-Reactor
MOX	FFTF
U-Mo/U-Zr	Fermi
HEU oxide	Shippingport PWR
U/Th oxide	Shippingport LWBR
Graphite/Carbide	Ft. St. Vrain
U-ZrHx	TRIGA
Aluminum based	ATR
LEU oxide	TMI debris



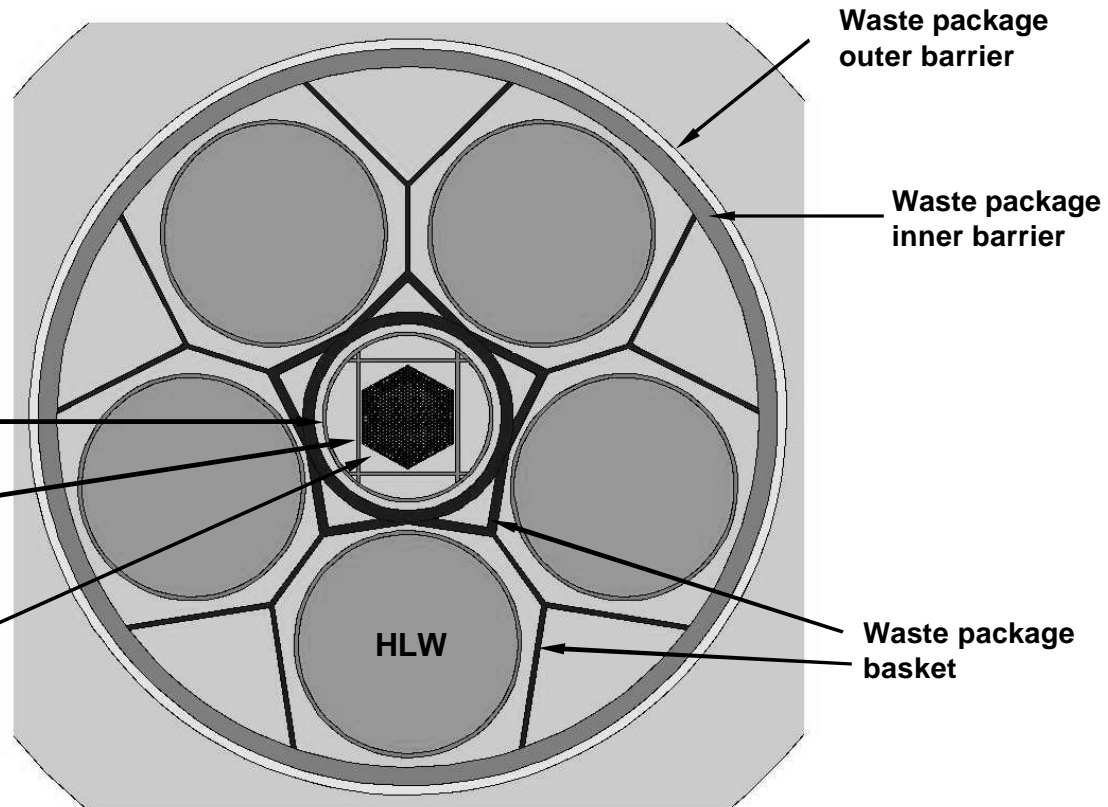
Examples of Configuration

**DOE standardized
canister with
Shippingport LWBR
driver assembly**

**DOE standardized canister for
Shippingport LWBR**

SS 316L basket plates

**Gadolinium neutron
absorber beads added
to basket after fuel
loading**

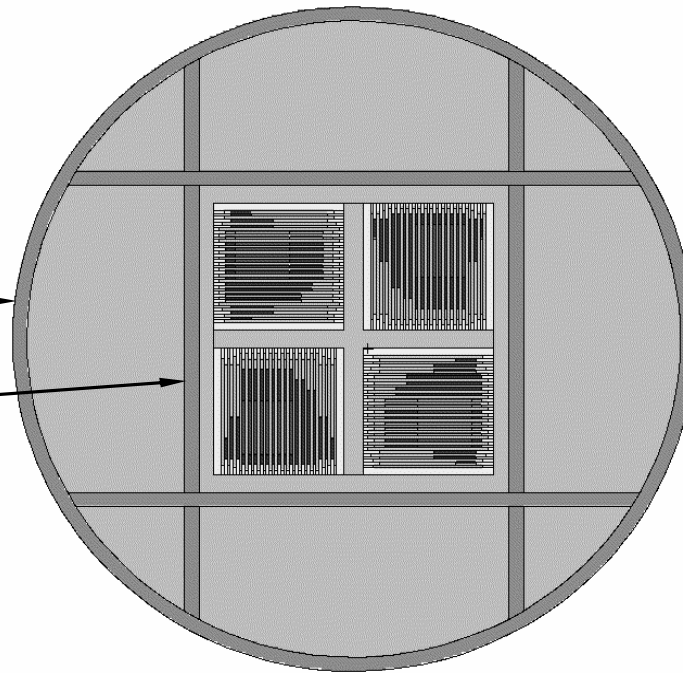


Examples of Configuration

**DOE standardized
canister with
Shippingport PWR
assembly**

DOE standardized canister for
Shippingport PWR

SS 316L basket plates



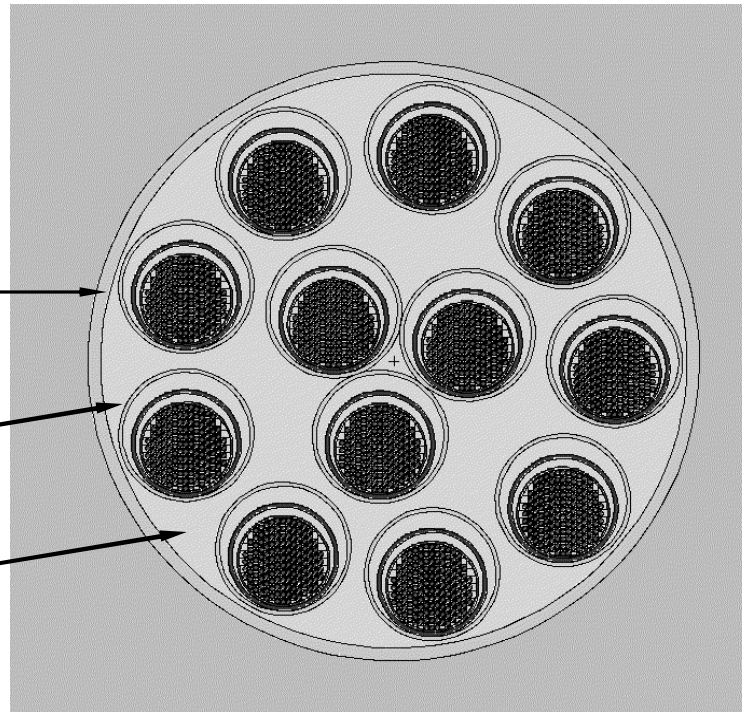
Examples of Configuration

DOE standardized canister with Fermi fuel assemblies

DOE standardized canister for
Fermi fuel

Basket consists of
gadolinium neutron
absorber tubes

Additional gadolinium
neutron absorber beads
preloaded between the
tubes

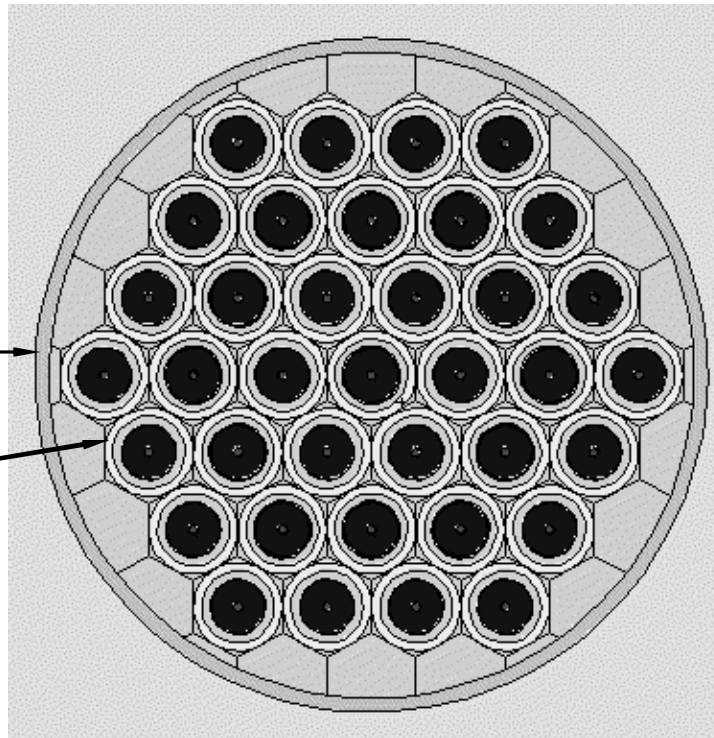


Examples of Configuration

**DOE standardized
canister with TRIGA
fuel assemblies**

DOE standardized canister for
TRIGA fuel assemblies

Basket consists of
gadolinium neutron
absorber tubes



Criticality Analyses Use

- These criticality analyses support Site Recommendation and License Application
- And also have been provided to the cask vendors to support initial transportation cask design



DOE SNF Inventory Covered

- Criticality analyses of the representative fuels cover

Representative fuel	MTHM	MTHM remain in group
N-Reactor	2096.2	14.1
FFTF	10.8	1.6
Fermi	3.9	0.7
Shippingport PWR	3.5	6.1
Shippingport LWBR	21.9	28.3
Ft. St. Vrain	26.3	0.1
TRIGA	1.9	0.03
ATR	5.5	11.9
TMI debris	81.8	91.3
Total	2251.8	154.1



Providing for safe, efficient disposition of DOE spent nuclear fuel

Important Criticality Parameters

- Based on the results of the completed criticality analyses, important criticality parameters for the analyzed fuel configurations are:
 - Fissile mass
 - Enrichment
 - Fissile isotopes
 - Linear loading per canister
 - Hydrogen/fissile [H/X] ratio



Packaging Strategies to Include Remaining DOE Inventory

- Based on the important criticality parameters
- Used the configurations analyzed to package the remaining DOE SNF inventory



Results Published In

- *Packaging Strategies for Criticality Safety for Other DOE SNF in the Repository*, DOE/SNF/REP-090 was issued in June 2004 that documented the strategies to package the “other” DOE SNF
- Using the analyzed configurations and important criticality parameters as a guide, we believe another 4% of the DOE SNF inventory could be covered by the completed criticality analyses



Summary

- This report identifies how the “other” DOE SNF may be packaged using the analyzed fuel configurations and still meet the repository criticality safety concerns
- The results indicate over 97% (MTHM) of the inventory will be covered by the analyzed configurations
- Less than 3% of the DOE SNF inventory will require special consideration
- The remaining inventory could be placed into analyzed configurations when more detail fuel information becomes available

